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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/535,466	05/17/2005	Maxim Fradkin	FR 020122	6154

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EXAMINER	
REDDING, THOMAS M	
ART UNIT	**PAPER NUMBER**
2624	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/535,466	FRADKIN ET AL.	
	Examiner	Art Unit	
	Thomas M. Redding	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6 and 15* is/are rejected.

7)☒ Claim(s) *7-14* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *17 May 2005* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *2/16/2007, 5/17/2005*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. Figures 3 and 4 are objected to as depicting a block diagrams without "readily identifiable" descriptors of each block, as required by 37 CFR 1.84(n). Rule 84(n) requires "labeled representations" of graphical symbols, such as blocks; and any that are "not universally recognized may be used, subject to approval by the Office, if they are not likely to be confused with existing conventional symbols, and if they are readily identifiable." In the case of figures 3 and 4, the blocks are not readily identifiable per se and therefore require the insertion of text that identifies the function of that block. That is, each vacant block should be provided with a corresponding label identifying its function or purpose.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New

Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

2. Claim 5 is objected to because of the following informalities: Claim 5 uses the word "constraint" where it is apparent it is intended to be "contrain". That is "causing low local resolution to ***constraint*** local surface curvature ..." should be "causing low local resolution to ***constrain*** local surface curvature ..."

Similarly, claim 6 using the word "made" where is apparent the word "make" is intended. "having means to ***made*** feature confidence ..." should be "having means to ***make*** feature confidence ...".

Appropriate correction is required.

3. Claims 7-14 are objected to under 37 CFR 1.75(c) as being in improper form because a multiple dependent claim cannot depend from any other multiple dependent claim. See MPEP § 608.01(n). Accordingly, the claims have not been further treated on the merits.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1, 2 and 15 are rejected under 35 U.S.C. 102(e) as being anticipated by Huang et al. (US 2002/0133070 A1).

Regarding claim 1, Huang discloses [a]n image processing system having image data processing means of automatic adaptation of 3-D surface Model to image features, for Model-based image segmentation ("The field of the invention is magnetic resonance angiography", paragraph 1), comprising means of dynamic adaptation of the Model resolution to image features including means of locally setting higher resolution when reliable image features are found and means of setting lower resolution in the opposite case ("the invention includes acquiring and reconstructing a 3D image, acquiring and reconstructing a 3D mask image, producing a 2D projection image at a selected projection angle through the 3D image, producing a 2D projection mask image at the selected projection angle through the 3D mask image, and subtracting the 2D projection mask image from the 2D projection image", Huang, paragraph 14, reliable blood vessel

image features are displayed at full resolution, other features are suppressed, effectively having no resolution).; and comprising viewing means for visualizing the images ("image data may be archived on the tape drive 112, or it may be further processed by the image processor 106 in accordance with the teachings of the present invention and conveyed to the operator console 100 and presented on the display 104", Huang, paragraph 24).

Regarding claim 2, Huang teaches having data processing means to define a feature confidence parameter for each image feature ("acquiring and reconstructing a 3D mask image", Huang, paragraph 14, the mask image defines whether a region of the image is determined to be blood vessel structure or not), and to locally adapt model resolution according to it ("subtracting the 2D projection mask image from the 2D projection image", Huang, paragraph 14, image features that are not of interest are given zero weight).

Regarding claim 15, Huang teaches [a]n image processing method, comprising steps of acquiring image data of a 3-D image with image features ("The present invention is a method and apparatus for producing a 2D projection image from a 3D image data set", Huang paragraph 14), and automatically adapting 3-D surface Model to image features, for Model-based image segmentation ("angiogram-like picture of the vascular system", Huang, paragraph 9), whereby: dynamically adapting the Model resolution to image features including locally setting higher resolution when reliable

image features are found and setting lower resolution in the opposite case ("subtracting the 2D projection mask image from the 2D projection image", Huang, paragraph 14); and comprising steps of visualizing the images ("image data may be archived on the tape drive 112, or it may be further processed by the image processor 106 in accordance with the teachings of the present invention and conveyed to the operator console 100 and presented on the display 104", Huang, paragraph 24).

6. Claims 1, 2, 6/1, 6/2 and 15 are rejected under 35 U.S.C. 102(b) as being anticipated by Delingette (General Object Reconstruction Based on Simplex Meshes, 1999).

Regarding claim 1, Delingette teaches [a]n image processing system ("DEC Alphastation 200/233", page 137, column 2, paragraph 4) having image data processing means of automatic adaptation of 3-D surface Model to image features ("The first stage corresponds to the mesh deformation from an initial position to a close approximation of the dataset shape", Delingette, page 127, column 1, paragraph 4), for Model-based image segmentation ("The different tasks performed during the reconstruction include the segmentation of given objects in the scene", Delingette, page 111, abstract), comprising means of dynamic adaptation of the Model resolution to image features (Delingette, page 121, figure 9b) including means of locally setting higher resolution when reliable image features are found and means of setting lower resolution in the opposite case ("Simplex meshes as triangulations are unstructured meshes and

therefore can be locally refined or decimated", Delingette, Page 118, column 2, paragraph 2, and table 5 showing high refinement corresponding to reduced distance error); and comprising viewing means for visualizing the images ("a disadvantage of using simplex meshes over triangulations is that they must be triangulated in order to be displayed", Delingette, page 135, column 1, paragraph 3).

Regarding claim 2, Delingette discloses data processing means to define a feature confidence parameter for each image feature ("the refinement measure is linked to the maximum distance to the data", Delingette, page 137, column 2, paragraph 1), and to locally adapt model resolution according to it ("Meshes before and after refinement are shown in Fig. 27", Delingette, page 173, column 2, paragraph 2).

Regarding claims 6/2 and 6/1, the combination of Delingette and Migdal teaches means to made feature confidence available for model adaptation, comprising means to display the Model regions with different colors representing the confidence at the location of said regions for the user to supervise the deformation process of the Model and to locally assess its final quality (Delingette, Figure 21 (b) – color coding of the distance of mesh vertices to the dataset).

Regarding claim 15, Delingette discloses [a]n image processing method, comprising steps off acquiring image data of a 3-D image with image features, and automatically adapting 3-D surface Model to image features, for Model-based image

segmentation ("The first stage corresponds to the mesh deformation from an initial position to a close approximation of the dataset shape", Delingette, page 127, column 1, paragraph 4), whereby:

dynamically adapting the Model resolution to image features including locally setting higher resolution when reliable image features are found and setting lower resolution in the opposite case ("the refinement measure is linked to the maximum distance to the data", Delingette, page 137, column 2, paragraph 1) and comprising steps of visualizing the images ("a disadvantage of using simplex meshes over triangulations is that they must be triangulated in order to be displayed", Delingette, page 135, column 1, paragraph 3 and figures 27 and 29 are examples of Delingette's output images).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 3, 4, 6/3 and 6/4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Delingette (1998) and Bernardini et al. (US 6, 968,299 B1).

Regarding claim 3, Delingette teaches a data processing means to define a feature confidence parameter as a parameter that depends on the feature distance ("the refinement measure is linked to the maximum distance to the data", Delingette, page 137, column 2, paragraph 1) and having data processing means to penalize the large distances ("Meshes before and after refinement are shown in Fig. 27", Delingette, page 173, column 2, paragraph 2).

Delingette does not explicitly describe the estimation of quality of this feature including estimation of noise, and having data processing means to penalize the noisy, although close features.

Bernardini working in the same field of endeavor of 3d modeling through mesh generation ("a method and apparatus are disclosed for finding a triangle mesh that interpolates a set of points obtained from a scanning system", Bernardini, column 3, line 47) does teach the estimation of quality of this feature including estimation of noise, and having data processing means to penalize the noisy, although close features ("points lying below the surface will not be touched by the ball and will not be part of the reconstructed mesh, as shown in FIG. 2F", Bernardini, column 8, line 41, and "the ball-pivoting algorithm is robust in the presence of imperfect data", Bernardini, column 8, line 24, Bernardini's method omits noisy points resulting in coarser resolution in those regions).

It would have been obvious at the time the invention was made for one of ordinary skill in the art to use the ball-pivoting algorithm of Bernardini with the simplex mesh system of Delingette to provide a triangulation method that is "robust in the presence of imperfect data" (Bernardini, column 8, line 24)

Regarding claim 4, the combination of Delingette and Bernardini teaches data processing means for decreasing the resolution of the Model in absence of confidence and gradually increasing the resolution of the Model with the rise of feature confidence (Delingette, figure 27 shows resolution varying as a result of a refinement operation).

Regarding claim 5, the combination of Delingette and Bernardini discloses data processing means for causing low local resolution to constraint local surface curvature, for preventing the model surface from self-intersections ("Our deformable model framework is based on a Newtonian law of motion (see Eq. (10)) that includes a damping factor in order to prevent oscillations of the system." Delingette, page 135, column 2, paragraph 1 and "For $\gamma = 0.20$, we observe that the resulting mesh self-intersects", Delingette, page 136, paragraph 1, and "If γ is too small, the mesh may not converge towards the right shape, especially when the mesh is far away from the data.", Delingette, page 136, paragraph 2, Delingette reveals that when the mesh is farther away, as will occur at lower resolution, the mesh may not converge properly. He

provides a damping mechanism to increase the stability of the deformation in order to avoid self-intersection).

Regarding claims 6/3, 6/4 and 6/5 the combination of Delingette and Bernardini discloses means to made feature confidence available for model adaptation, comprising means to display the Model regions with different colors representing the confidence at the location of said regions for the user to supervise the deformation process of the Model and to locally assess its final quality (Delingette, Figure 21 (b) – color coding of the distance of mesh vertices to the dataset).

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Migdal et al. (US 6,262,739) teaches dynamic adjustment of mesh resolution by inserting or removing data points with respect to distance.

Vuylsteke et al. (US 5, 461,465) teaches that coarse resolution images have less noise than finer resolution images.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thomas M. Redding whose telephone number is (571) 270-1579. The examiner can normally be reached on Mon - Fri 7:30 am - 5:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian P. Werner can be reached on (571) 272-7401. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/TMR/

BRIAN WERNER
SUPERVISORY PATENT EXAMINER